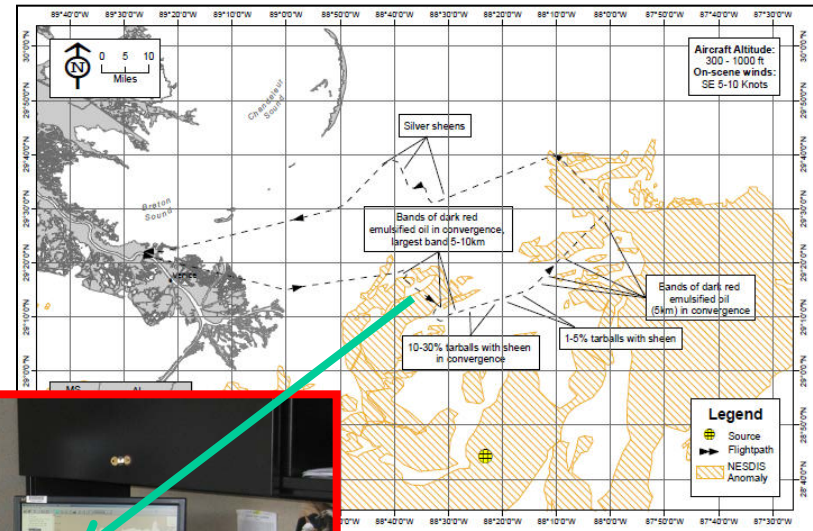
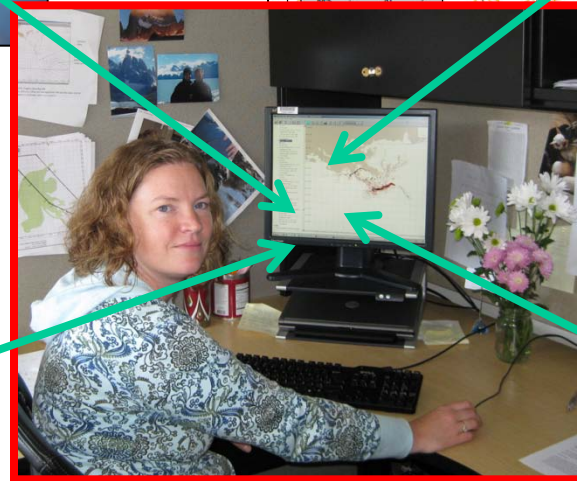
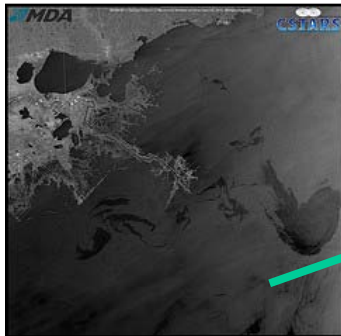
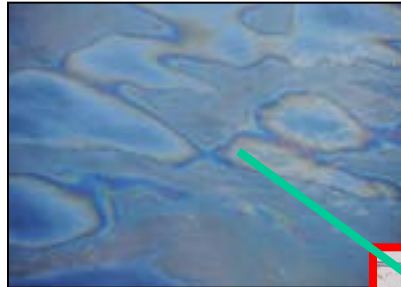


NOAA oceanographers use specialized computer models to predict the movement of spilled oil on the water surface. They predict where the oil is most likely to go and how soon it may arrive there. During a major spill response, they generate trajectory maps that show their predictions. The audience for these maps includes spill responders and decision-makers, information specialists, journalists, and the interested public.

How a trajectory forecast is created

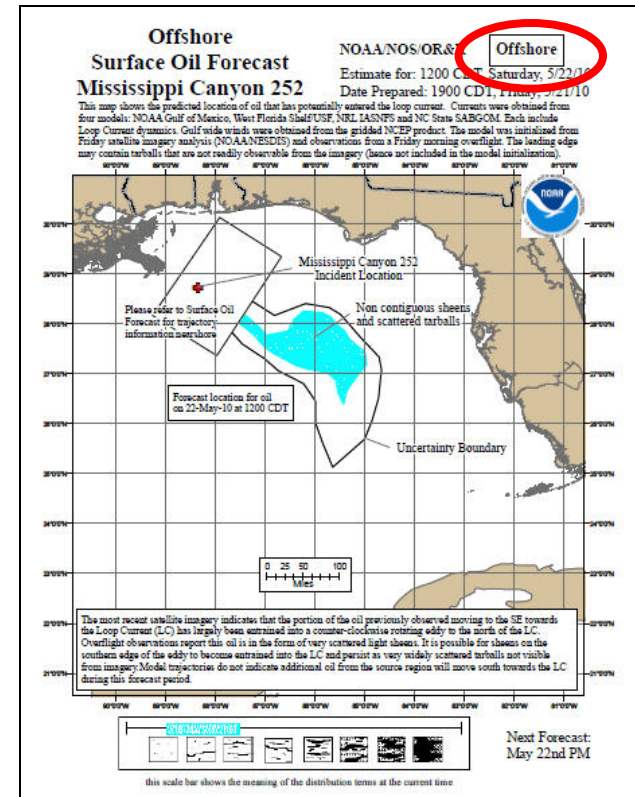
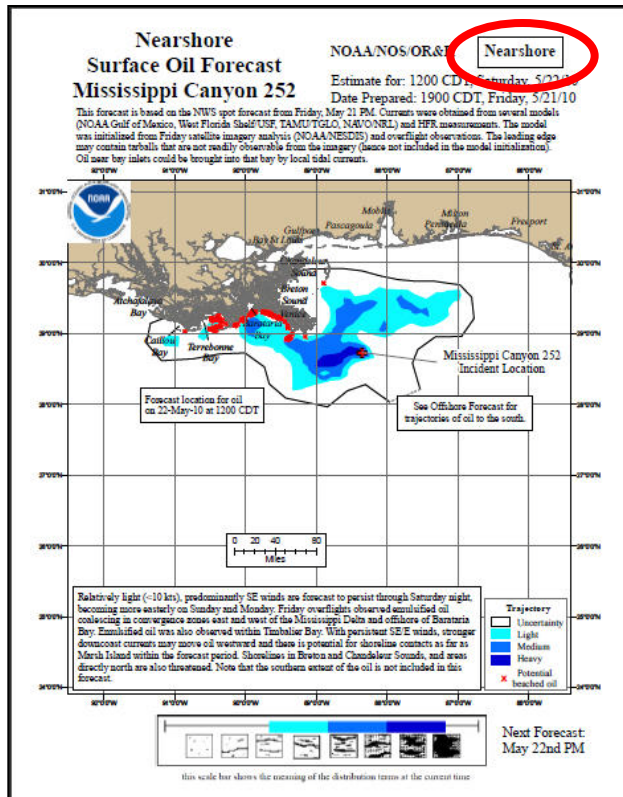


Oil on the water is moved by currents and winds. To run NOAA's oil spill trajectory model, GNOME, the NOAA oceanographers use: (1) currents predictions from a suite of oceanographic models, (2) satellite imagery analysis, (3) winds forecasted by the National Weather Service, and (4) on-scene observations reported by trained observers who have made aircraft overflights back and forth across the potentially affected area, recording locations where oil is seen. GNOME forecasts the movement and spreading of the oil.

The oceanographic models used for a given forecast are listed on the trajectory map.



Two kinds of Surface Oil Forecasts each day



Because the oiled/potentially oiled zone covers such a large area, the oceanographers are producing two types of Surface Oil Forecast maps each day.

“Nearshore” covers the area closest to land

“Offshore” covers offshore waters

3 of each for 1, 2, and 3 days in the future

Every evening, the maps are posted on response.restoration.noaa.gov (as PDFs)

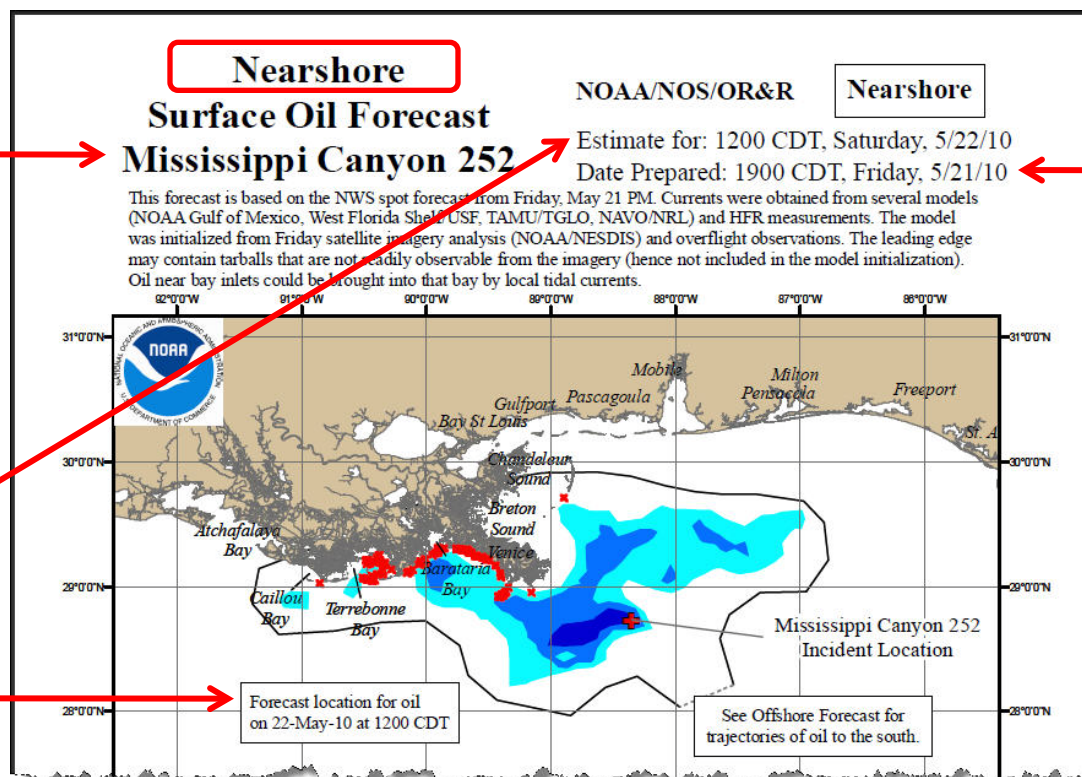
Next, we’ll look at the parts of the map (which are the same for both maps).



Some basic information

NOAA's name
for the
Deepwater
Horizon oil spill

Predicted oil
locations on the
map are for this
date and time



The map was
prepared at
this date and
time

This slide shows where important basic information is shown:

NOAA uses Mississippi Canyon 252 as the name of the incident because the damaged wellhead is within Mississippi Canyon Block 252.

The map was prepared at the date/time shown as “Date Prepared”. The map depicts the forecasted extent of the oil on 1, 2, or 3 days in the future. This map was prepared on Friday, May 21, and depicts the forecast for Saturday, May 22 – just 1 day into the future.

Of course, the forecast becomes less certain when the prediction is made for more days out, and is least certain for 3 days out.



Oiled areas are shown as overlapping color-coded patches. These patches represent the amounts of oil predicted to be present at the time and date for which the forecast was made. Dark blue areas show where the greatest amounts of oil are predicted to be, medium blue areas show where medium amounts of oil are predicted to be, and light blue areas show where the least amounts of oil are predicted to be.

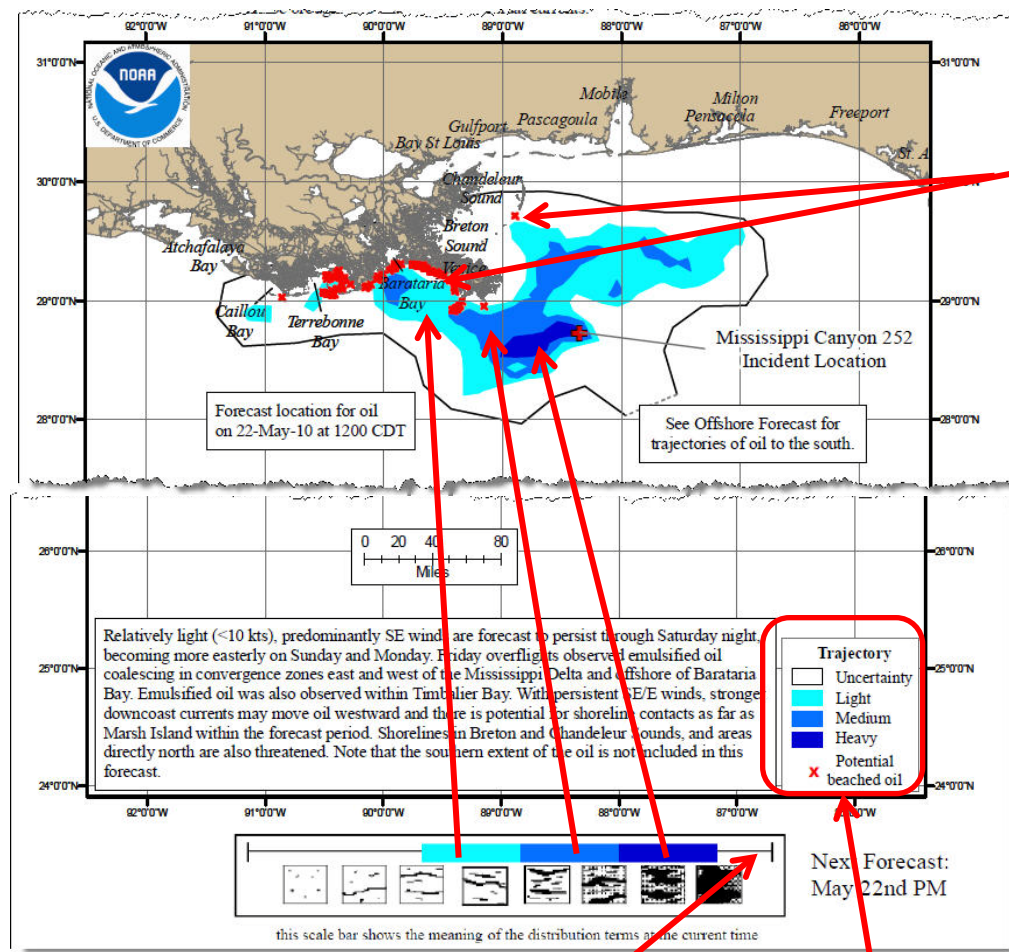
Amount of oil: The relative amount of oil is determined by both the thickness of the oil on the water and percent coverage. Percent coverage is a measure of how completely the oil covers the water surface. Percent coverage is 100% if you would see no water between patches and streamers of oil when looking from above.

The oil coverage scale bar at the bottom of each trajectory map shows graphically how the oil in the color-coded areas might look to an observer viewing from above. The greater the coverage, the greater the amount of oil (and the less water is visible between patches and streamers of oil).

Red "x"s on the map mark locations where NOAA predicts that oil may beach during the forecast period (the time interval between when the models were run and the date and time for which the predictions were made). The map does *not* show areas where real oil has actually beached.

Notice that there's a distance scale bar to help you estimate the extent of areas predicted to be oiled.

Areas predicted to be oiled



Locations of potentially beached oil

Oil coverage scale bar

Oil coverage legend



The oceanographers draw a black line—the uncertainty boundary—around the blue-shaded areas on the map to indicate that there’s a chance that oil could be located anywhere inside this boundary.

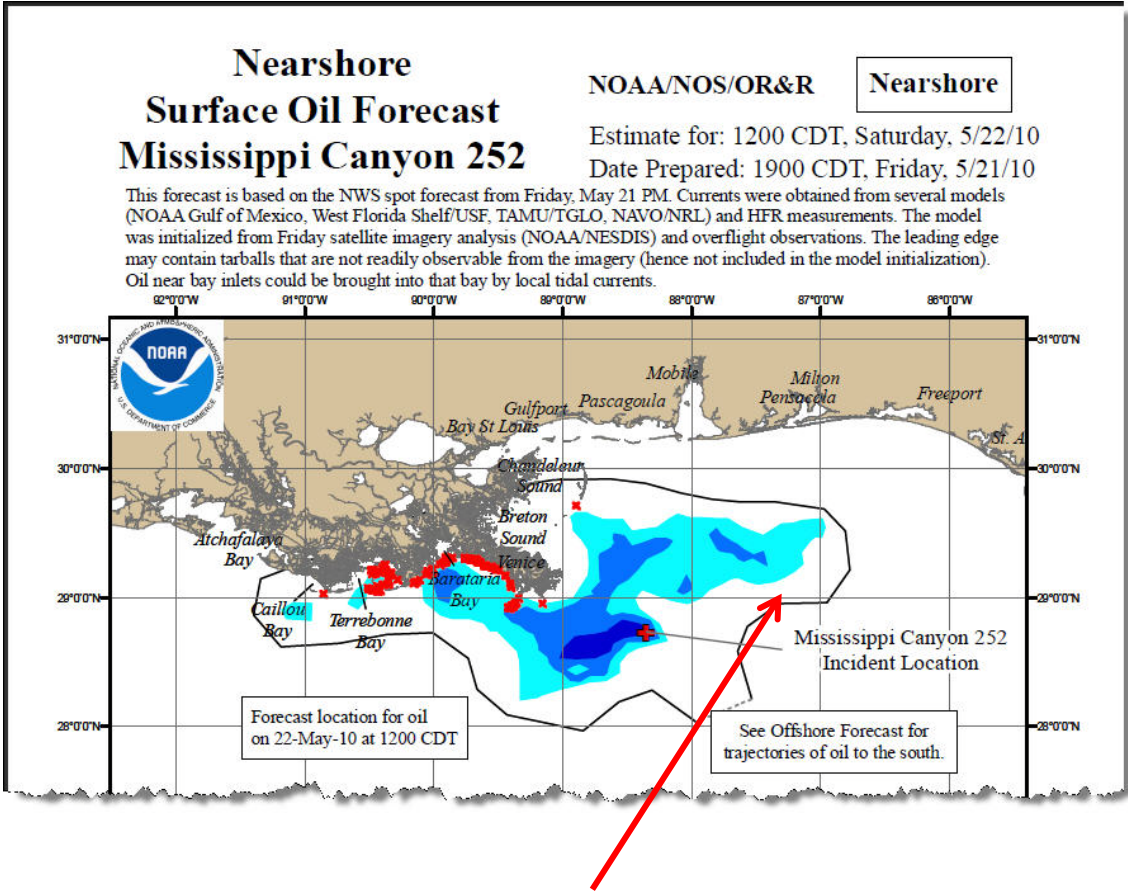
The oil is *most likely* to be located within the blue-shaded areas, but it *might* be present anywhere inside the uncertainty boundary.

The uncertainty boundary is based on the extent of the differences among the models as well as inevitable inexactness in our knowledge of currents and winds, and other model inputs. It’s not the result of formal statistical analysis of uncertainty.

The approach taken by NOAA’s trained oil spill modelers is very like that of experienced meteorologists who skillfully synthesize weather observations and model predictions to develop an effective weather forecast.

It takes 3 to 4 hours for NOAA’s oceanographers to produce a forecast of the trajectory of an oil spill for a forecast period.

The uncertainty boundary



Uncertainty Boundary
There’s a chance oil could be
located anywhere inside this line



Above and below the map are short blocks of text to aid you in interpreting the map. At the top of this map, the text block describes how the NOAA oceanographers modeled the trajectory of the oil:

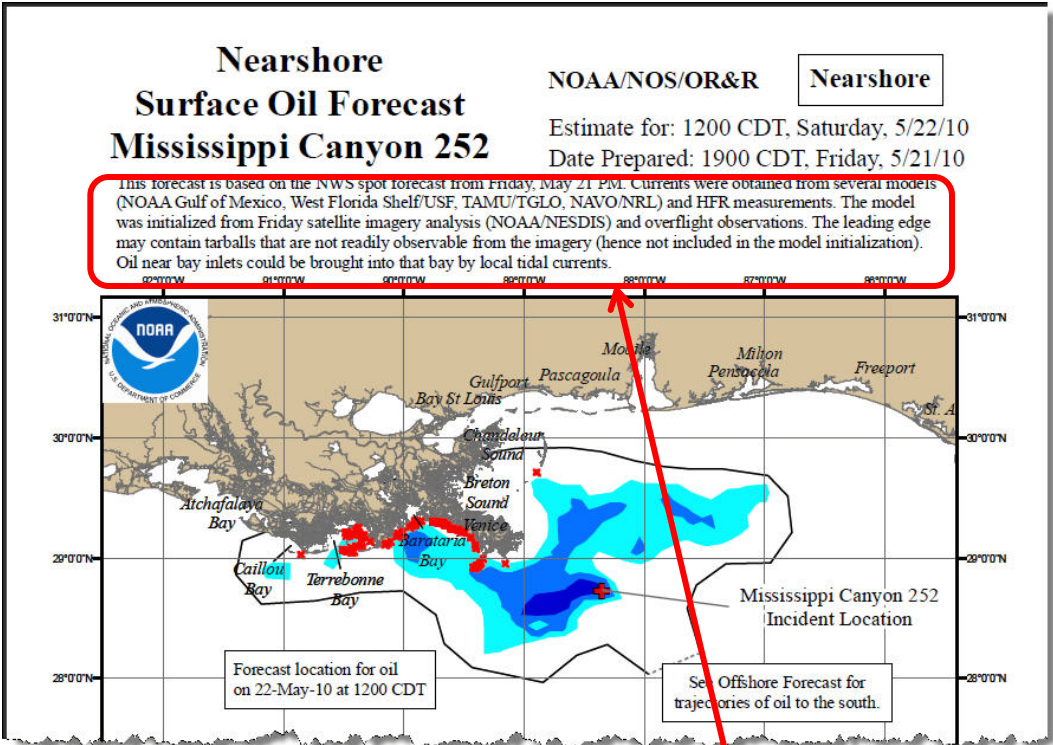
National Weather Service forecast information for this location was used.

Four leading ocean current models were used to forecast current patterns in the affected area. The models make these predictions using a wide range of forcing functions (mathematical depictions of the forces that make water move). For example, they take into account winds, river outflow, water density structure, and boundary forcing (the larger ocean's influence on the waters of the Gulf of Mexico), as well as bathymetry and shoreline data for the Gulf of Mexico. High-frequency radar (HFR) surface current measurements also were used.

NOAA's oil spill trajectory model was used to predict the movement of the spilled oil during the 3-day forecast period. This model was initialized using the current predictions, as well as satellite images of the area and observations from trained observers who have observed and reported areas where oil is present. Satellite images provide a general sense of where the oil may be located, but these images must be ground-truthed by observers.

Finally, the last two sentences in the text block at the top of this example page alert you that there are two possible reasons why oil *might* be present in locations where it is not predicted to be on the map. (1) Because tarballs float low in the water, they may not be observed by satellites or human observers. They may be present outside of the color-coded areas or even the uncertainty boundary on the map. (2) Local tidal currents might bring oil into bay inlets.

Text above the map



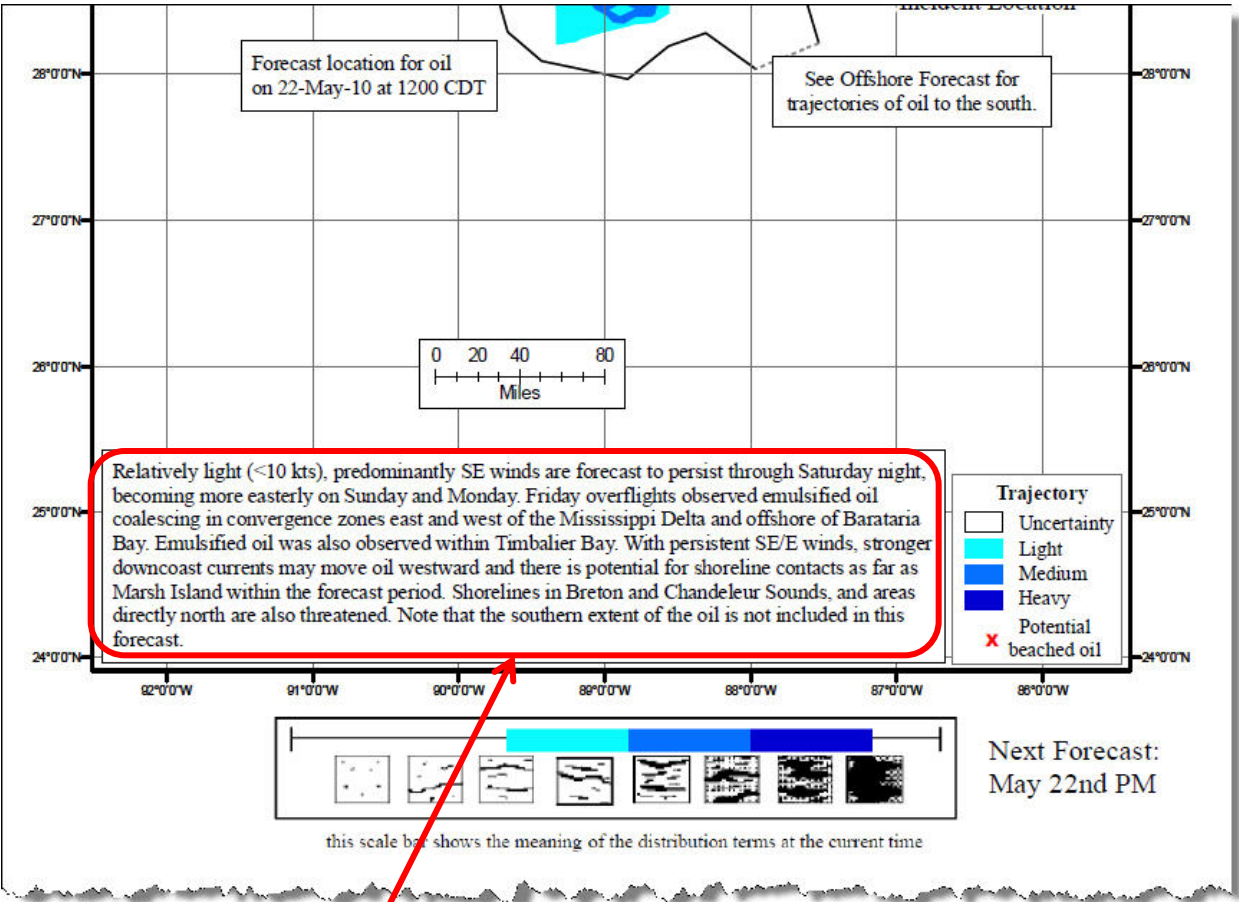
Information about how the oil trajectory was modeled



The text block at the bottom of the map provides more details about the map, including

- (1) the predicted weather during the forecast period, along with
- (2) notes providing key observations made during overflights, discussion of how expected weather is likely to influence movement of the oil, and locations most likely to be threatened during the forecast period.

Text below the map



Additional notes about the predicted oil movement



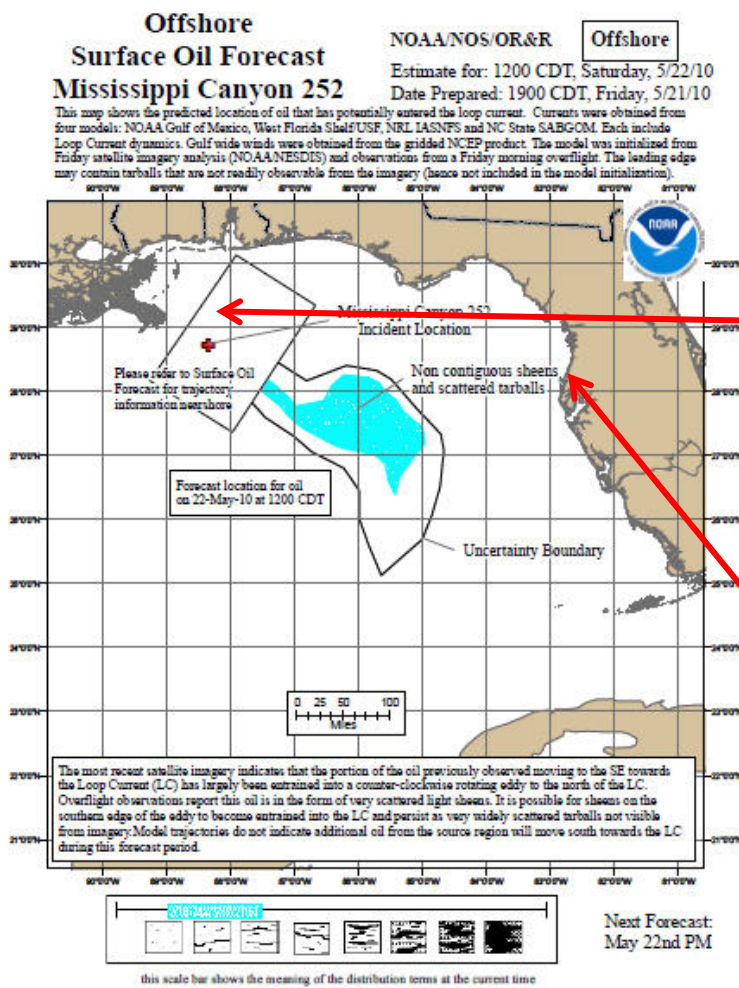
Generally, the same features that you find on the nearshore map are included in the offshore map, except:

- (1) A box shows the area covered by the nearshore map (and therefore not shown on this map).
- (2) No legend is included to explain the color-coding. Instead, on the offshore map, the area shown in blue represents the predicted area where oil is present at the forecast date and time. That area is annotated with additional information, as in this example map.

The area where oil is forecasted to be on this map is shown in stippled light blue to indicate that the amount of oil in this area, in terms of both thickness and area covered, is much, much less than the amounts of oil shown on the nearshore map.

When only a small amount of oil is present, as is depicted on this map, even if no response actions are taken, natural processes will reduce it to below a level of concern within a few days to a few weeks. The most important natural processes that break down oil include evaporation, dissolution, natural dispersion, photo-oxidation (breaking down of the oil by sunlight) and biodegradation.

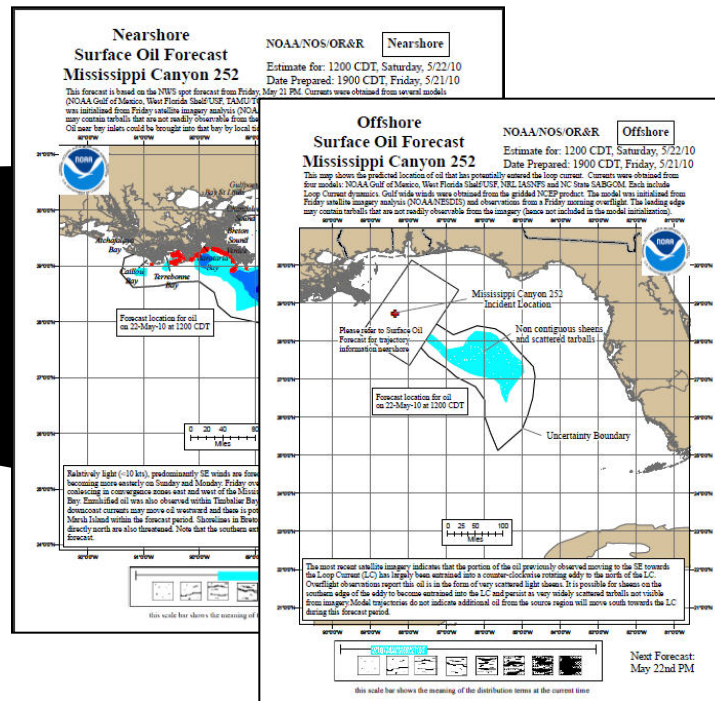
The offshore map



Box showing area covered by nearshore map

Additional information about the oil coverage





Some final points:

NOAA uses the best available models and information to prepare these oil spill trajectory forecast maps, yet the maps incorporate uncertainties at many levels. They are never exact maps of the real situation.

NOAA's trajectory forecast maps are designed to help people make decisions during oil spill responses. They provide only one of many kinds of information that those decision-makers need. Just for starters, they also need to know what areas are especially important to protect (e.g., locations used by vulnerable or economically valuable species; tourist areas, ports, and other economically and culturally valuable locations). They need to know what protection measures could be effective at which locations.

Two questions for general discussion:

If you had the job of planning the response actions for tomorrow, how would you use these trajectory maps?

How would you deal with the uncertainty that's inherent in these maps?

